WHAT IS CLAIMED IS:

1. An exhaust gas purification apparatus for an internal combustion engine, comprising:

a NOx storage-reduction catalyst which is disposed in an exhaust passageway of the internal combustion engine, and which selectively traps and stores a specific component that includes at least one of nitrogen oxides (NOx) and sulfur oxides (SOx) from an exhaust gas coming into the NOx storage-reduction catalyst by at least one of adsorption and absorption when the exhaust gas coming into the catalyst has an air-fuel ratio lean of stoichiometry, and which releases the specific component stored and removes the specific component through reduction when the exhaust gas coming into the catalyst has a stoichiometric or rich-of-stoichiometry air-fuel ratio;

a estimation device that estimates an amount of storage of the specific component in the NOx storage-reduction catalyst and an amount of release of the specific component from the NOx storage-reduction catalyst; and

a regeneration device that performs a regeneration operation of releasing the specific component stored in the NOx storage-reduction catalyst and removing the specific component through reduction by supplying a rich-of-stoichiometry exhaust gas to the NOx storage-reduction catalyst based on the amount of storage of the specific component estimated by the estimation device,

wherein the estimation device estimates the amount of storage of the specific component and the amount of release of the specific component with respect to each one of at least two different portions of the NOx storage-reduction catalyst.

2. The exhaust gas purification apparatus according to claim 1, wherein the estimation device indicates the amount of storage of the specific component in each portion of the NOx storage-reduction catalyst by using a storage counter, and estimates the amount of storage of the specific component in each portion of the NOx storage-reduction catalyst by incrementing the storage counter at a rate proportional to a concentration of the specific component in the exhaust gas coming into the NOx storage-reduction catalyst when the exhaust gas coming into the catalyst has an air-fuel ratio lean of stoichiometry, and decrementing the storage counter at a predetermined rate when the exhaust gas coming into the catalyst has a stoichiometric or rich-of-stoichiometry air-fuel ratio.

3. The exhaust gas purification apparatus according to claim 1, wherein the estimation device estimates the amount of storage of the specific component in each portion of the NOx storage-reduction catalyst by distributing an entire amount of the specific component storable in the NOx storage-reduction catalyst to the at least two portions of the NOx storage-reduction catalyst at a predetermined distribution ratio while the NOx storage-reduction catalyst is trapping and storing the specific component.

4. The exhaust gas purification apparatus according to claim 1, wherein the estimation device estimates the amount of storage of the specific component in each portion of the NOx storage-reduction catalyst by determining the amount of release of the specific component from each portion of the NOx storage-reduction catalyst during the regeneration operation for the NOx storage-reduction catalyst.

5. The exhaust gas purification apparatus according to claim 3, wherein the estimation device sets the predetermined distribution ratio in accordance with the amounts of storage of the specific component in the at least two portions of the NOx storage-reduction catalyst.

6. The exhaust gas purification apparatus according to claim 3, wherein the estimation device sets the predetermined distribution ratio in accordance with a degree of degradation of the NOx storage-reduction catalyst.

7. The exhaust gas purification apparatus according to claim 3, wherein the estimation device sets the predetermined distribution ratio in accordance with a temperature of the NOx storage-reduction catalyst.

8. The exhaust gas purification apparatus according to claim 3, wherein the estimation device sets the predetermined distribution ratio in accordance with an amount of flow of exhaust gas into the NOx storage-reduction catalyst.

9. The exhaust gas purification apparatus according to claim 3, wherein the estimation device sets the predetermined distribution ratio in accordance with a concentration of the specific component in an exhaust gas flowing into the NOx storage-

reduction catalyst.

10. The exhaust gas purification apparatus according to claim 4, wherein the estimation device comprises an O_2 sensor that is disposed downstream of the NOx storage-reduction catalyst and that detects an exhaust oxygen concentration, and estimates the amount of the specific component released from each portion of the NOx storage-reduction catalyst based on an output of the O_2 sensor during the regeneration operation for the NOx storage-reduction catalyst.

11. The exhaust gas purification apparatus according to claim 1, wherein the generation device performs the regeneration operation based on a total of estimated amounts of storage of the specific component in the at least two portions of the NOx storage-reduction catalyst.

12. The exhaust gas purification apparatus according to claim 1, wherein the regeneration device determines a duration of maintaining the air-fuel ratio of the exhaust gas flowing into the NOx storage-reduction catalyst at a stoichiometric air-fuel ratio after a short time of maintaining the air-fuel ratio rich of stoichiometry during execution of the regeneration operation based on the amount of storage of the specific component in a specific portion among estimated amounts of storage of the specific component in the at least two portions of the NOx storage-reduction catalyst.

13. The exhaust gas purification apparatus according to claim 12, wherein the specific portion of the NOx storage-reduction catalyst is a portion that has a lower rate of release of the specific component during execution of the regeneration operation than another portion of the NOx storage-reduction catalyst.

14. An exhaust gas purification method for an internal combustion engine including a NOx storage-reduction catalyst which is disposed in an exhaust passageway of the internal combustion engine, and which selectively traps and stores a specific component that includes at least one of nitrogen oxides (NOx) and sulfur oxides (SOx) from an exhaust gas coming into the NOx storage-reduction catalyst by at least one of adsorption and absorption when the exhaust gas coming into the catalyst has an air-fuel ratio lean of stoichiometry, and which releases the specific component stored and removes

the specific component through reduction when the exhaust gas coming into the catalyst has a stoichiometric or rich-of-stoichiometry air-fuel ratio, the method comprising the steps of:

estimating an amount of storage of the specific component in the NOx storage-reduction catalyst and an amount of release of the specific component from the NOx storage-reduction catalyst; and

performing a regeneration operation of releasing the specific component stored in the NOx storage-reduction catalyst and removing the specific component through reduction by supplying a rich-of-stoichiometry exhaust gas to the NOx storage-reduction catalyst based on the amount of storage of the specific component,

wherein the estimating step estimates the amount of storage of the specific component and the amount of release of the specific component with respect to each one of at least two different portions of the NOx storage-reduction catalyst.

15. The exhaust gas purification method according to claim 14, wherein the estimating step indicates the amount of storage of the specific component in each portion of the NOx storage-reduction catalyst by using a storage counter, and estimates the amount of storage of the specific component in each portion of the NOx storage-reduction catalyst by incrementing the storage counter at a rate proportional to a concentration of the specific component in the exhaust gas coming into the NOx storage-reduction catalyst when the exhaust gas coming into the catalyst has an air-fuel ratio lean of stoichiometry, and decrementing the storage counter at a predetermined rate when the exhaust gas coming into the catalyst has a stoichiometric or rich-of-stoichiometry air-fuel ratio.

16. The exhaust gas purification method according to claim 14, wherein the estimating step estimates the amount of storage of the specific component in each portion of the NOx storage-reduction catalyst by distributing an entire amount of the specific component storable in the NOx storage-reduction catalyst to the at least two portions of the NOx storage-reduction catalyst at a predetermined distribution ratio while the NOx storage-reduction catalyst is trapping and storing the specific component.

17. The exhaust gas purification method according to claim 14, wherein the estimating step estimates the amount of storage of the specific component in each portion of the NOx storage-reduction catalyst by determining the amount of release of the specific

component from each portion of the NOx storage-reduction catalyst during the regeneration operation for the NOx storage-reduction catalyst.

18. The exhaust gas purification method according to claim 16, wherein the estimating step sets the predetermined distribution ratio in accordance with the amounts of storage of the specific component in the at least two portions of the NOx storage-reduction catalyst.

19. The exhaust gas purification method according to claim 16, wherein the estimating step sets the predetermined distribution ratio in accordance with a degree of degradation of the NOx storage-reduction catalyst.

20. The exhaust gas purification method according to claim 16, wherein the estimating step sets the predetermined distribution ratio in accordance with a temperature of the NOx storage-reduction catalyst.

21. The exhaust gas purification method according to claim 16, wherein the estimating step sets the predetermined distribution ratio in accordance with an amount of flow of exhaust gas into the NOx storage-reduction catalyst.

22. The exhaust gas purification method according to claim 16, wherein the estimating step sets the predetermined distribution ratio in accordance with a concentration of the specific component in an exhaust gas flowing into the NOx storage-reduction catalyst.

23. The exhaust gas purification method according to claim 17, wherein the estimating step detects an exhaust oxygen concentration of downstream of the NOx storage-reduction catalyst, and estimates the amount of the specific component released from each portion of the NOx storage-reduction catalyst based on the exhaust oxygen concentration of downstream of the NOx storage-reduction catalyst during the regeneration operation for the NOx storage-reduction catalyst.

24. The exhaust gas purification method according to claim 14, wherein the generating step performs the regeneration operation based on a total of estimated amounts

of storage of the specific component in the at least two portions of the NOx storage-reduction catalyst.

25. The exhaust gas purification method according to claim 14, wherein the regenerating step determines a duration of maintaining the air-fuel ratio of the exhaust gas flowing into the NOx storage-reduction catalyst at a stoichiometric air-fuel ratio after a short time of maintaining the air-fuel ratio rich of stoichiometry during execution of the regeneration operation based on the amount of storage of the specific component in a specific portion among estimated amounts of storage of the specific component in the at least two portions of the NOx storage-reduction catalyst.

26. The exhaust gas purification method according to claim 25, wherein the specific portion of the NOx storage-reduction catalyst is a portion that has a lower rate of release of the specific component during execution of the regeneration operation than another portion of the NOx storage-reduction catalyst.